New Approaches to Remote Sensing-Based Grassland Assessment

Dakota Prairie Grasslands Meeting, Bismarck, ND
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Outline

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- Progress on Remote Sensing Applications Since 2010
- Research versus Applications approach
- Current Project
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Grassland Assessment Issues

- Less than 1% of the landscape is captured by the Robel Pole measurements. How **spatially representative**?
- Robel Pole measurements are time consuming and **costly.** What is the USFS investment per acre or per square mile each year?
- Prairie grassland **structure changes** with species, weather and senescence. Results are not simply a function of management.
- There have been **issues with grazers** over these Robel Pole problems for a number of years.

Progress on Remote Sensing DPG since 2010

- We can **spatially represent structure** using sensors on-board satellites and airplanes.
- Satellite-based data can be provided each year **at a fraction of the Robel Pole field survey cost.**
- Models employed with remote sensing data **account for grassland changes** and support adaptive management.
- Presentations of remote sensing-based maps **to USFS and grazers have been met with support.**
- We have published this **original research** in three peer-reviewed publications.

Research versus Applications Approach

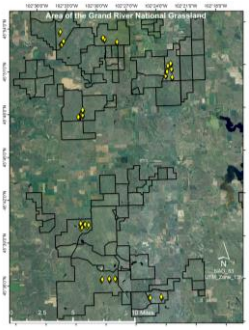
- **Research was conducted to determine multivariate relationships** between species, leaf area, plant moisture, percent species cover, percent bare ground, canopy height, green biomass, topography senescent biomass, historical reflectance, season and spectral bands (from 7 to 130, depending on sensor) to achieve quantitative estimates of total biomass at the GRNG in South Dakota.
- Original models were reviewed and published in three journals.
- Applications required simplified models to reduce costs, so that the USFS could budget additional grassland assessments in North Dakota.
- We report development of simplified models at lower costs that, compared to the Robel Pole method, will result in savings and more reliable maps of grassland structure.

Current Project

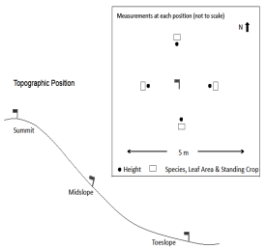
Objective: Can we provide broad-brush, grassland-wide estimates of structure with minimal field data at a reasonable cost? Yes.

Background for understanding how this is achieved

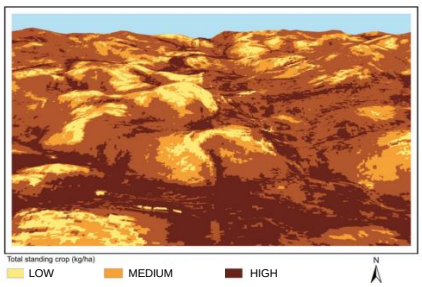
SCALE: WEATHER REPORT

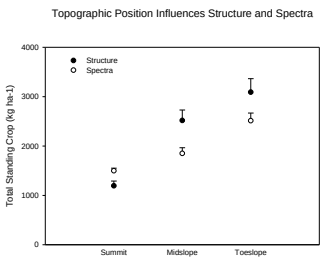


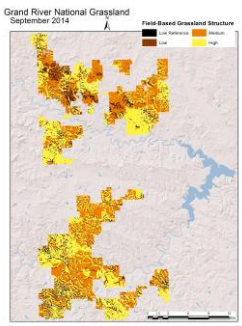
SCALE AND PHYSIOGRAPHY

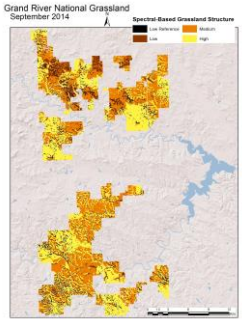


HIGH, MEDIUM, LOW









Results Summary

		Spectra + Topo + Field Model	
		Ha	%
Low Reference		1,349	4.4
Low		1,031	3.4
Medium		13,282	43.8
High		14,723	48.4
	Total	30,385	
		Spectra + Topo Model	
		Ha	%
Low Reference		1,349	4.4
Low		1,548	5.1
Medium		13,666	45.0
High		13,822	45.5
	Total	30,385	

Conclusions and Next Steps

- Grassland spatiotemporal variation in structure can be modelled to provide more reliable, cost-effective estimates.
- Lessons learned at the GRNG through REM funding can be leveraged to provide state-of-the-art information at minimal expense.
- USFS range conservationists can drive through areas mapped on a GPS to compare maps with field views.
- Dissemination and education
- Little Missouri National Grassland

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MONITORING IDAHO FESCUE GRASSLANDS IN THE BIG HORN MOUNTAINS, WYOMING, WITH A MODIFIED ROBEL POLE

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Abstract.—The reliability of monitoring visual obstruction and estimating standing herbage with a modified Robel pole was examined for high-elevation meadows in sedimentary soils on the Bighorn National Forest, Wyoming. Our objectives were to (1) test a modified pole graduated with 1.27-cm (0.5-inch) bands for estimating standing herbage based on linear regression of visual obstruction readings (VORs) on standing herbage, (2) validate the derived regression, (3) provide sample size estimates, and (4) develop guidelines for monitoring mountain grasslands. Each transect had 20 visual obstruction stations spaced 10 meters apart with 4 visual obstruction readings at each station. At 4 stations, vegetation within a 0.25-m^2 area was clipped at ground level. VORs and clipped standing herbage were averaged by transect for analysis. Visual obstruction reliably predicted average standing herbage (dry weight) for mountain meadows ($r^2 = 0.81$, $s_{y \cdot x} = 382$ kg · ha^{-1}). Standing herbage ranged from 387 kg · ha^{-1} to 3600 kg · ha^{-1}, with a mean of 1742 kg · ha^{-1}. A validation data set of 13 transects sampled across the range of variation in standing crop showed that 85% of transects fell within the 90% prediction limits. We recommend a minimum of 4 transects for monitoring key areas or small areas up to 259 ha (640 acres) when managers need to consider differences in VOR bands and address multiple objectives. Cluster analyses (ISODATA) applied to the pole readings resulted in 4 visual obstruction categories: short, short-intermediate, tall-intermediate, and tall. This tool provides a simple, reliable, and cost-effective (time-saving) alternative to clipping vegetation and obtaining dry weights for monitoring.

Monitoring Standing Herbage of Mid-Grass Prairie on the Fort Pierre National Grassland, South Dakota

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ABSTRACT Monitoring vegetation with a modified Robel pole on the Fort Pierre National Grassland was evaluated for combined shallow clay and loamy overflow ecological sites (dominated by warm season grasses), and for clayey ecological sites (dominated by cool season grasses). My objectives were to 1) develop a relationship between visual obstruction readings (VOR) and standing herbage, 2) provide guidelines for vegetation monitoring, and 3) evaluate vegetation monitoring during the growing season for clayey ecological sites. The relationship between visual obstruction readings and standing herbage was linear and regression coefficients were highly significant ($P < 0.001$) for both ecological types. Cluster analyses for shallow clay and loamy overflow ecological sites grouped the VOR and standing herbage (kg•ha^{-1}) into 4 resource categories. Monitoring with 4 transects will provide adequate information to estimate standing herbage within 259 ha (1 section). Three resource categories (VOR + herbage) for clayey ecological sites were defined by cluster analyses. Monitoring with 4 transects was determined to provide reliable estimates of standing herbage. July validation of vegetation with the developed clayey ecological site model will provide reliable monitoring of standing herbage from July through November for this ecological site.